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THE AMERICAN LOBSTER (Homarus americanus)

Prepared in the Division of Fishery Biology

Classification: The American lobster is a crustacean belonging to the order Decapoda, which includes also the spiny lobsters, crayfishes, shrimps, prawns, and crabs. Each of these represents a separate family, that of the American lobster being the family Nephropsidae, which includes only true lobsters. The Nephropsidae are the best known of the Crustacea because of their high commercial value as food. The family is represented by three species: the Norwegian lobster, Nephrops norvegicus; the common lobster of Europe, Homarus gammarus; and the common lobster of America, Homarus americanus.

Range: The American lobster is found only on the eastern coast of North America, where its range includes a strip of coastline some 1,300 miles long but generally not more than 30 to 50 miles wide, although off Cape Cod this strip broadens to nearly 200 miles on Georges Bank. The most northern point from which the capture of a lobster has been recorded is Henley Harbor, Labrador; the most southern, the coast of North Carolina. Although prior to about 1910 the lobster had been reported only four times from this southern portion of its range, it is now taken in marketable quantities in the recently developed otter trawl fishery off the Virginia and North Carolina capes. The depths inhabited by the lobster range from one to more than 100 fathoms. Its migrations consist chiefly of an offshore movement into deeper water in the fall and a return toward shore in April and May; there are in addition random coastwise movements which are not of great extent. The large lobsters on the offshore grounds in Maine show a greater tendency to migrate than the smaller individuals of the bays and coves. The results of tagging experiments indicate that none of the migrations of the lobster are extensive. In Maine and New Hampshire the average distance of the point of recapture from the place where tagged was between one and two miles after a period of one year. In Rhode Island, Connecticut, and New York the lobsters moved slightly greater distances; however, not enough lobsters have been tagged as yet in southern New England to permit accurate tracing of their movements. The lobster is most abundant in the northerly parts of its range - eastern Maine, the Maritime Provinces of Canada, and Newfoundland.

Attempts to transplant: A number of attempts have been made to transplant the American lobster to the Pacific coast, but without success. In the years 1874, 1879, 1888, and 1899, a total of 104,000 larvae and 355 adult lobsters were planted in California waters and 233 adults were released in Puget Sound and off the mouth of the Columbia River in Washington. Also two lobsters were liberated in Great Salt Lake, Utah. The results of all of these transfers were unsuccessful. Between 1906 and 1917, efforts to transplant lobsters were intensified. A total of 24,572 lobsters were planted in Puget Sound, Washington, and 1,532 in Yaquina Bay, Oregon. It is evident that these lobsters also failed to survive and reproduce.

Size: Although the average total length of the lobsters taken for market is from 9 to 10 inches, these crustaceans may attain a much greater size if allowed to round out the full term of life. In the Bulletin of the Bureau of Fisheries for 1909 there was published a tabulation of 14 of the largest lobsters ever captured on the Atlantic coast, for which authentic weights and measurements were preserved. The giant among these weighed 34 pounds and measured 23-3/4 inches in body length. If it had been measured with the large claws stretched to their fullest extent in front of the head the length would have been nearly doubled. Even this record was broken by a 45-pound lobster caught in the winter of 1935-56 off the Virginia Capes and now on exhibition at the Boston Museum of Natural History.

Habits: Like all other large and heavy crustaceans, the lobster is an inhabitant of the ocean floor. Although its powers of locomotion are considerable, it seldom leaves the sea bottom, where it moves nimbly about on the tips of its slender legs. The large claws are usually directed forward while the long sensitive feelers or antennae continually sweep back and forth to sense the presence of enemies or food. When alarmed, the lobster may swim rapidly backward by rapid flexion of its muscular tail.

The lobster is an animal of essentially nocturnal habits as it explores the bottom in quest of food mainly after sundown. Often it captures its prey by stealth, lying hiddin in seaweeds, rock crevices, or in its burrow in the mud to await the approach of a victim. The food of the adult lobster consists principally of fish, alive or dead, almost all kinds of invertebrate animals that inhabit the bottom, and small quantities of algae and eel grass. While lobsters are notorious scavengers, it is probable that they usually prefer fresh food to stale. They are very fond of clams and other mollusks, and when kept in pounds are constantly exploring and digging up the bottom, in search of them.

Keeping lobsters alive out of water or in aquaria: Lobsters breathe by means of gills located on each side of the body under the shell or carapace, the blood in the finely divided gill filaments absorbing oxygen dissolved in the water and giving off carbon dioxide. Lobsters can live out of water for limited periods, provided the gills are kept moist so that the exchange of gases may take place and provided the air is kept cool. Under such favorable circumstances individuals have been kept alive as long as three weeks.

Small numbers of lobsters often can be held for some time in aquaria or wooden tanks supplied with natural sea water, provided proper attention is given to aerating the water and keeping it cold and free from pollution. Because sea water contains a large number of substances in addition to common salt, the preparation of artificial sea water should be done only by a trained chemist. If a wooden tank is used, the inside should be coated white with waterproof enamel paint. At least 6 inches of sea water should be poured into the tank and the lobsters should be scrubbed clean before they are placed in the tank. Any debris which accumulates should be removed by means of a siphon.

If the lobsters do not live as well as expected in such an aquarium, the first difficulty to be considered is lack of oxygen; the second, too high temperature; and, the third, pollution of the water by waste products of the crustaceans. Standing water in an aquarium can be supplied with oxygen by a small, inexpensive electric air pump such as is used by aquarium fanciers and advertised in aquarium magazines. The outlet of the air pipe should be fitted with porous material to break up the bubbles of air, thus facilitating absorption of the oxygen by the water. The water temperature should be kept between 50 and 55 degrees Fahrenheit, which can best be done by pumping the water from the tank through a cooling chamber and returning it to the tank again. In small aquaria a simple metal container for ice may be placed at one end of the tank to cool the water. The ice should never be placed directly in the aquarium because it would harmfully dilute the sea water. To eliminate pollution, the water should be changed at least once a week, or oftener if possible.

If lobsters are to be kept in large quantities, elaborate equipment is required to provide for recirculating the water between the display tank where the lobsters are kept and a larger storage tank for sea water, with an intervening filter and aerator to purify the water before storage and a refrigeration tank to cool it before returning it to the display tank. Even with such equipment no assurance can be given as to the length of time the lobsters may be expected to live.

Growth and molting: Molting is an incident and expression of growth. It commonly occurs from June to October, although shedding may take place as late as December. The time, however, varies considerably, in some seasons occurring from 4 to 6 weeks earlier in western Maine than in the extreme eastern section. The crustacean does not grow by molting, as is sometimes said, but molts because it has grown, and the rigid shell restricts further growth. Shortly after molting the body increases in size, probably in part through absorption of water, but this expansion should be distinguished from the change that has already taken place due to cellular growth and which is the primary cause of the molt.

Molting begins between the second and fifth day after hatching and is repeated at intervals throughout life, or at least as long as there is growth. The increase in length at each molt varies with the size of the lobster. The small lobsters increase as much as 20 percent at each shedding, while the large ones average less than 9 percent growth. When sexually mature, the female increases in size less at each molt than the male. The male probably molts more often than the female.

The adult female usually molts and produces eggs but once in two years. As a rule the female lays her eggs in July and August and carries them until the following summer when they hatch. The molt follows soon after the eggs are hatched. Rarely a second molt occurs in the fall, winter, or spring, and molting just before the production of new eggs also is not common.

Shedders (lobsters about to molt, and soft lobsters which have just molted) are not fit for market because they are lean and watery and are not able to withstand much handling or transportation. Until the shell becomes rather hard, which occurs in from 6 to 8 weeks, the soft lobster is easily injured or killed. Lobsters with very soft shells and those that have been mutilated are often kept in lobster preserves or pounds until the shell is hardened or the injury repaired.

Reproduction: The size at which sexual maturity is attained varies in different areas. In certain parts of Canada, spawning may occur in females as small as 7 inches long; while in the United States egg-bearing females below 9 inches are seldom found. In Maine and New Hampshire the average size at maturity is 11-1/2 inches or more while in Long Island Sound and Rhode Island, maturity is reached at 10 to 11 inches.

Mating occurs in summer during the molting season; actual spawning takes place in the following spring. The female is impregnated or supplied with sperm by the male immediately following a molt, while her shell is in a soft condition. The hard-shelled male turns the soft female upon her back and transfers the sperm to the female by means of two horny abdominal appendages. The sperm remains in the female's pouch until spawning occurs.

The spawning interval is a biennial one, two years elapsing between periods of egg laying. The spawning period for the majority of lobsters is July to September, but a very few lay eggs during June or October. In the middle and eastern districts of Maine it is two weeks later than in Vineyard Sound, Mass. In 1893, 71 percent of the eggs examined from the coast of Maine were extruded in the first half of August.

To perform the spawning act, the female turns on her back and flexes the abdomen into a pocket. The eggs then flow from the genital openings at the bases of the third pair of walking legs in a steady stream into the pocket, passing over the sperm receptacle on their way. At this time the sperm cells leave the receptacle and fertilize the eggs. The eggs adhere to the abdominal appendages or swimmerets where they are carried by the female throughout the period of incubation.

The number of eggs laid varies with the size of the individual. The law of production may be expressed as follows: The number of eggs produced at each reproductive period increases in a geometrical series, while the length of lobsters producing these eggs increases in an arithmetical series. According to this law an 8-inch lobster produces 5,000 eggs, a lobster 10 inches long 10,000, and a 12-inch lobster 20,000. This high rate of increase is not maintained beyond the length of 14 to 16 inches. Lobsters about 15 to 16 inches long produce approximately 97,000 eggs.

Incubation: The period of incubation occupies between 10 and 11 months. The egg-bearing lobster instinctively folds her tail, thus securely enclosing the eggs in the abdominal pocket when in danger from enemies; at other times she extends her tail at intervals and moves her swimmerets back and forth. In this way the eggs are aerated and cleaned. As a result of this care, the eggs pass through the storms and stress of winter with remarkably little loss. Hatching occurs at night or on cloudy days, and the newly-hatched young are dispersed by the violent agitation of the mother's swimmerets.

Development of the young: The young lobster emerges from the egg as a free-swimming creature whose powers of locomotion, however, are not strong enough to prevent its being carried by currents. The habits of the larval lobster in nature are not well known, but from the results of capturing them in nets, it appears that they are often attracted to the surface by strong sunlight. The young are extremely active, and have strongly developed fighting and preying habits. Their voracious appetites result in cannibalism whenever the food supply is insufficient or unsuitable. During the course of development the young lobsters pass through a number of distinct stages, the first of which commonly lasts from 1 to 5 days. Low water temperature or insufficient food supply delays the molting. In habits, color, and general appearance the first three larval stages show no striking differences. With the attainment of the fourth stage, however, the lobsterlings for the first time attain the characteristic form of the race. Toward the end of this period the young usually sink to the bottom and begin to display their racial instincts of fear and caution. Rarely descent is delayed until the fifth or sixth stage. The general habits and movements of the young thereafter are the same as those of the adults.

Decline in abundance: The lobster fishery of New England has shown a general decline since 1889, when 30,500,000 pounds were marketed. In 1940 the total catch was 11,165,300 pounds, although there were almost twice as many traps fished as in 1889. Tables 1 and 2 show the decreasing trend of the catch and the catch per pot.

The evident depletion of the fishery has had repercussions in the economic welfare of a great many North Atlantic fishing communities. The lobster fishery provides part or all of the income of great numbers of small boat fishermen from Maine to New Jersey. The decline in the catch and the relatively low prices to the fishermen have produced insufficient returns to those who depend on this fishery for a livelihood.

Conservation measures: Realizing that lobsters have become less abundant, the states producing them in commercial quantities have enacted various regulatory measures and the United States Fish and Wildlife Service is carrying on a long-range program of biological study designed to determine the best methods for increasing the lobster population. Any such increase will directly benefit the fishermen for it will make possible a greater catch with the same fishing effort.

Most important of the present conservation measures are protection of egg-bearing females, minimum-size laws designed to allow small lobsters to escape the fishery, and in Maine a maximum-size law to prevent the sale of the large lobsters which are the most prolific egg producers. At present no lobster under 3-1/8 inches, measured from the eye socket to the end of the carapace, can be sold in the states of Maine, New Hampshire, Massachusetts, New York, or Delaware. A 3-1/16 inch minimum size is in effect in Rhode Island, Connecticut, and New Jersey.

TABLE 1.--Comparative Statistics of the Lobster Fishery of the New England States for Various Years from 1880 to 1940

Year	Maine	New Hampshire	Massachusetts	Rhode Island	Connecticut
	Pounds	Pounds	Pounds	Pounds	Pounds
1880	14,234,182	250,000	4,315,416	423,250	613,385
1887	22,916,642	142,824	3,511,075	570,039	1,487,020
1888	21,694,731	136,350	3,743,475	588,500	1,477,226
1889	25,001,351	137,175	3,353,787	456,000	1,501,290
1892	17,642,677	196,350	3,182,270	774,100	1,614,530
1898	11,183,294	108,515	1,693,741	578,066	1,098,192
1900	12,346,450	205,122	1,805,042	660,017	550,450
1902	12,163,389	128,463	1,695,688	397,305	371,650
1905	9,018,759	256,052	1,283,071	529,827	436,790
1909[1/]	9,929,000	264,000	2,455,000	1,425,000	681,000
1913	7,670,667	301,710	1,524,389	1,283,056	724,435
1919	5,545,884	298,012	2,387,636	1,694,327	740,848
1924	5,513,002	125,600	1,679,601	1,696,346	701,647
1928	7,100,332	130,099	2,042,331	1,637,659	693,558
1929	6,620,615	125,198	1,630,531	1,353,515	592,607
1930	7,750,682	180,587	2,338,234	1,353,107	734,712
1931	7,166,310	143,289	2,245,753	1,259,173	497,494
1932	6,056,932	219,803	2,146,371	1,257,204	589,809
1933	5,897,685	216,929	1,928,616	708,095	336,800
1935	7,687,200	194,400	1,805,300	619,000	546,400
1937	7,348,500	155,800	2,134,900	773,800	522,900
1938	7,659,200	170,200	2,315,100	709,700	553,600
1939	7,570,800	178,900	2,337,800	635,800	588,200
1940	7,643,000	235,800	2,438,500	372,600	475,400

[1/] From data published by the Bureau of the Census.

TABLE 2.--Total Yield of New England Lobster Fishery in Relation to Change in Fishing Intensity for Various Years from 1880 to 1940

Year	Pounds	Number of pots	Catch per pot[1/]
1880	19,836,233	141,540	140 pounds
1887	28,627,600	161,504	177 "
1888	27,640,282	161,588	171 "
1889	30,449,603	175,458	174 "
1892	23,409,927	197,074	119 "
1898	14,661,808	205,049	72 "
1900	15,567,081	204,376	76 "
1902	14,756,495	212,690	69 "
1905	11,524,499	190,364	61 "
1908[2/]	14,734,000	262,002	56 "
1913	11,504,257	249,024	46 "
1919	10,666,707	239,558	45 "
1924	9,716,196	256,662	38 "
1928	11,603,979	334,574	35 "
1929	10,322,466	345,824	30 "
1930	12,357,322	332,788	37 "
1931	11,312,019	357,704	32 "
1932	10,279,119	341,595	30 "
1933	9,088,125	319,460	28 "
1935	10,852,300	289,437	37 "
1937	10,935,900	306,130	32 "
1938	11,984,000	302,510	40 "
1939	11,311,500	330,246	34 "
1940	11,165,300	328,988	34 "

1/ The "catch per pot" has been computed by dividing the total poundage by the number of pots. It is recognized that the decline in catch per pot is not an absolute measure of decline in abundance, because the factor of competition between units of gear is introduced when the number of pots is greatly increased. Furthermore, the figures for total pots represent only total pots used, and do not show how many months they were fished each year. It is believed, however, that this figure gives a better indication of the extent of the decline than do the catch figures alone.

2/ From data published by the Bureau of the Census.

In addition to fishing regulations, artificial propagation has been employed by the Fish and Wildlife Service and several states. In the rearing stations, the lobster eggs are hatched and the larval lobsters are held until they have molted three times. After the third molt, they are released along the coast. Although in earlier days the generally-practiced method was to plant larvae shortly after they had emerged from the egg, it is now felt that better survival can be achieved if the lobsters are released after they are ready for life on the bottom, i.e., during the fourth stage.

State lobster hatcheries and rearing stations are located in three New England commonwealths and there are Federal stations at Gloucester, Mass., and Boothbay Harbor, Me. The state establishments are at Noank, Conn., Wickford, R. I., and Boothbay Harbor, Me.

While the value of artificial propagation in the restoration of the lobster fishery is not definitely established, there are indications that the work of rearing and planting young, being performed by the Fish and Wildlife Service and by the states, may be bringing about some improvement in conditions.

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Natural History of the American Lobster. Bulletin, U. S. Bureau of Fisheries, Vol. XXIX (1909) pp. 149-408. (Document 747) Out of print.

Nigrelli, Ross F. Lobster hatcheries to the rescue. Bulletin, New York Zoological Society, Vol. XXXIX, No. 6, Nov.-Dec. (1936) pp. 223-229.

Templeman, W. Lobster tagging in the Gulf of St. Lawrence. Journal, Biological Board of Canada, Vol. I. No. 4 (1935) pp. 269-278.

Further contributions to mating in the American Lobster. Journal, Biological Board of Canada, Vol. II, No. 2 (1936) pp. 223-226.

Influence of temperature, salinity, light, and food conditions on the survival and growth of the larvae of the lobster (Homarus americanus). Journal, Biological Board of Canada, Vol. II, No. 5, (1936) pp. 485-497.

Government publications that are out of print may be consulted usually in Government depository libraries.

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